Ice Flow with AMANDA muons

Ver. 0.1

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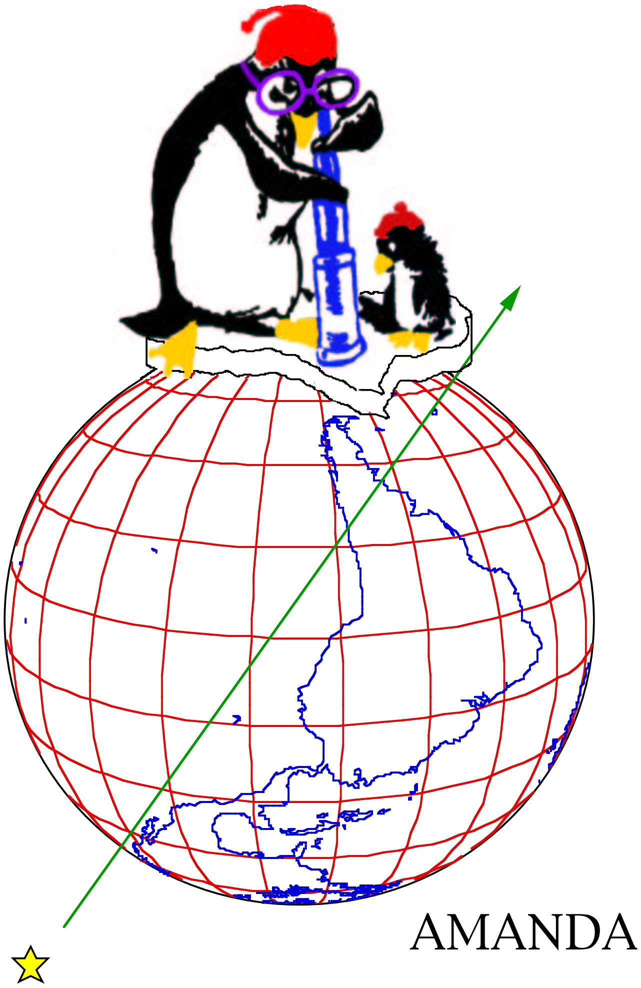
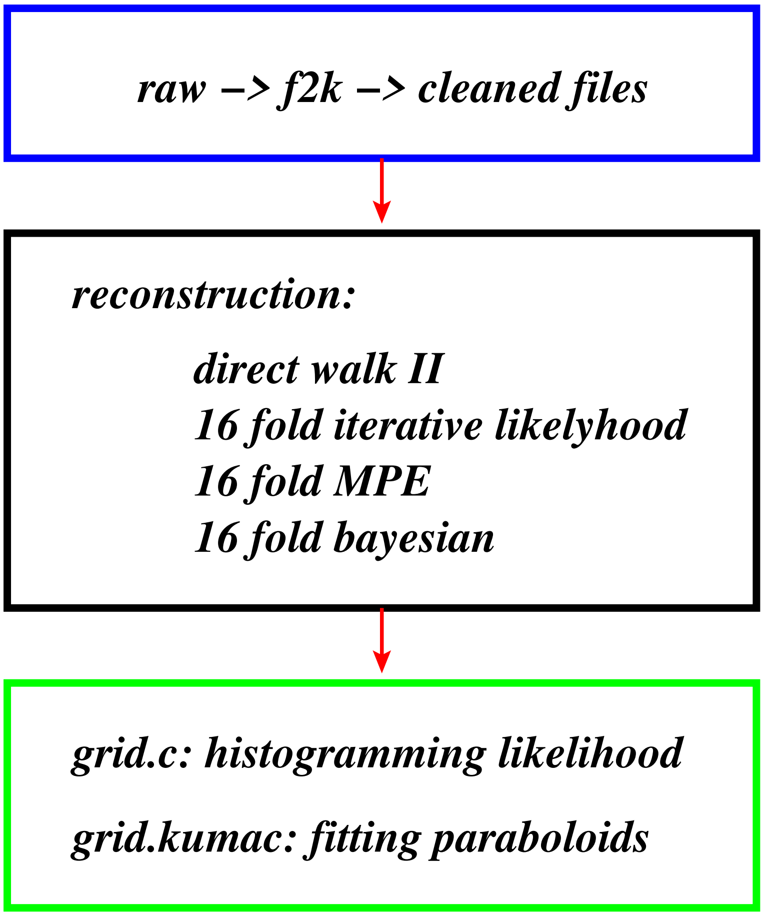
Talk outline



1. software update
2. data files
3. global properties
4. summary of results

Software update

All software was reviewed and a couple of minor bugs were repaired. All parts of the software are now organized into the web page: http://area51.berkeley.edu/d̃ima/work/GRID/scripts/.



Only those events which have hits in the bottom OMs (337-344, 379-386, 421-428) have been reconstructed. The bottom OMs themselves were not used in this reconstruction.

Software update

Only those hits in the bottom OMs which pass the standard cleaning (bad, noise and tot cross talk) and are in the 0:4500 window for years 1998, 1999 and in the -2000:4500 window for years 2000, 2001, and 2002 were used for evaluation of their likelihood contributions. In addition, all hits isolated by 100 m within 500 ns were removed.

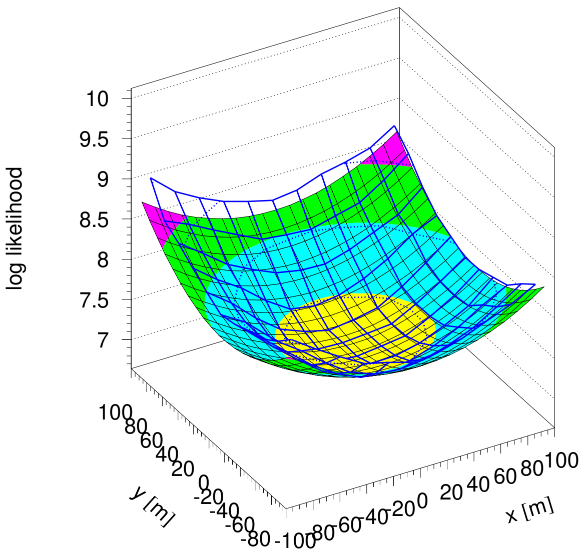
Data files

The following data periods were used:

year/day	files	total events	used events
1998/064	20	1256680	349948
1998/300	20	1240017	141235
1999/066	20	1080491	139537
1999/300	20	895856	119320
2000/055	10	395116	77753
2000/298	10	360077	57310
2001/056	10	337622	66193
2001/303	10	281542	51491
2002/059	10	511003	74776
2002/220	10	471752	106846

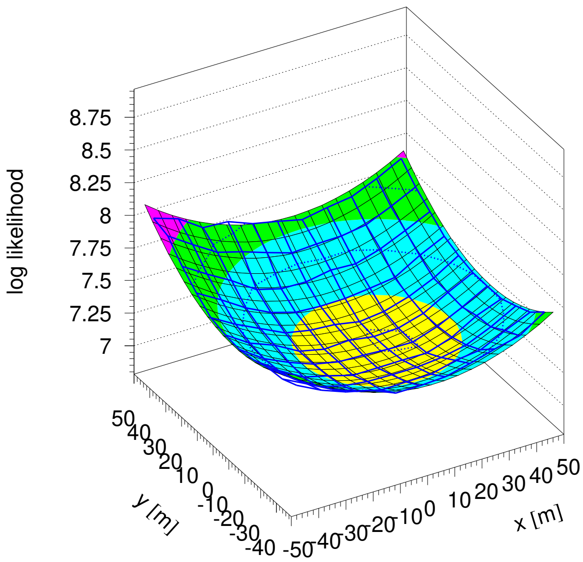
Global minimum

log likelihood for OM 425 at z = 60 m



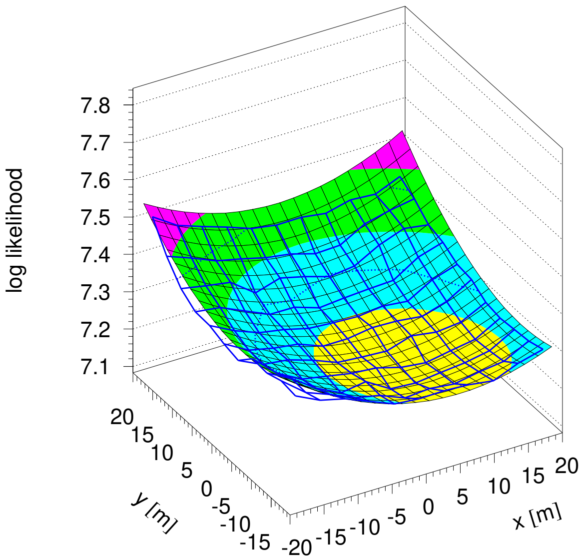
x_{min} = 5.178 ± 0.569 [m] δx_{min} = 89.65 ± 0.99 [m]
y_{min} = -9.988 ± 0.430 [m] δy_{min} = 83.48 ± 0.84 [m]
z_{min} = 69.101 ± 1.036 [m] δz_{min} = 104.68 ± 1.71 [m]

log likelihood for OM 425 at z = 40 m



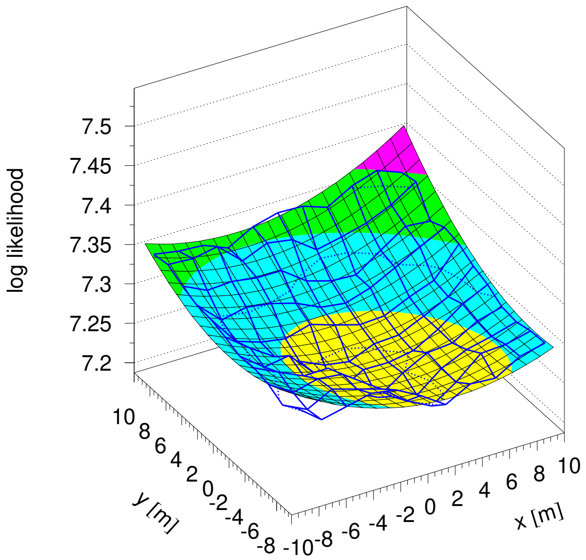
x_{min} = 5.623 ± 0.506 [m] δx_{min} = 58.44 ± 1.10 [m]
y_{min} = -8.837 ± 0.510 [m] δy_{min} = 59.50 ± 1.20 [m]
z_{min} = 43.105 ± 1.298 [m] δz_{min} = 75.15 ± 2.05 [m]

log likelihood for OM 425 at z = 20 m



x_{min} = 4.202 ± 0.815 [m] δx_{min} = 42.38 ± 2.53 [m]
y_{min} = -9.272 ± 0.859 [m] δy_{min} = 44.62 ± 3.28 [m]
z_{min} = 20.000 ± 0.303 [m] δz_{min} = 46.90 ± 1.30 [m]

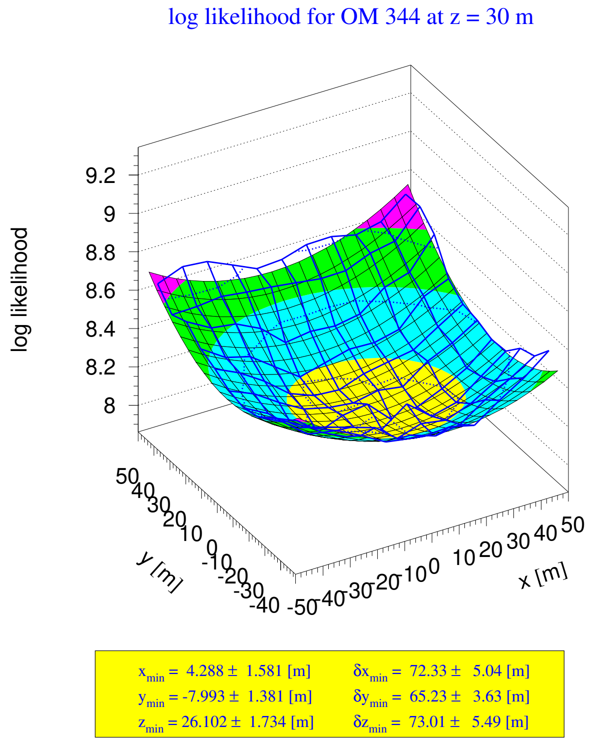
log likelihood for OM 425 at z = 10 m

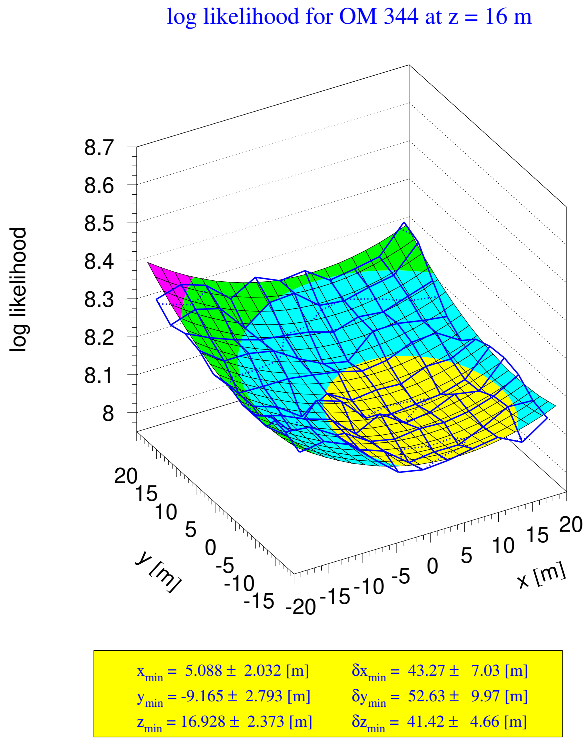


x_{min} = 0.869 ± 1.147 [m] δx_{min} = 32.50 ± 5.46 [m]
y_{min} = -4.457 ± 1.182 [m] δy_{min} = 35.13 ± 6.43 [m]
z_{min} = 10.000 ± 0.452 [m] δz_{min} = 32.20 ± 1.53 [m]

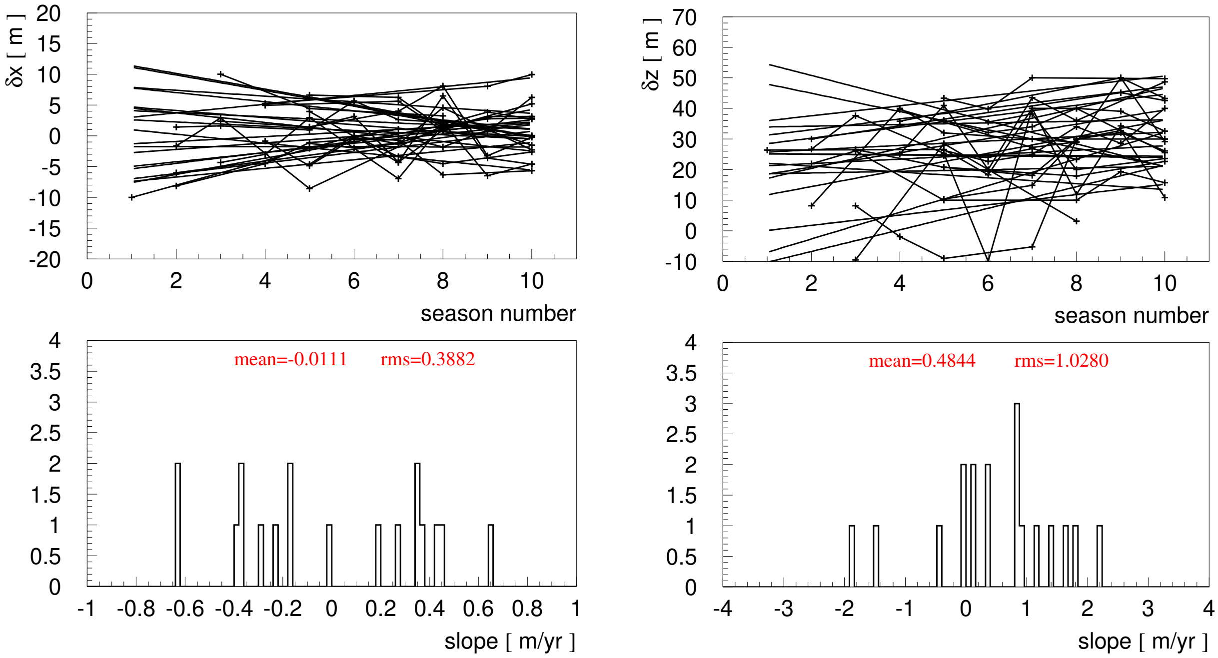
Global minimum

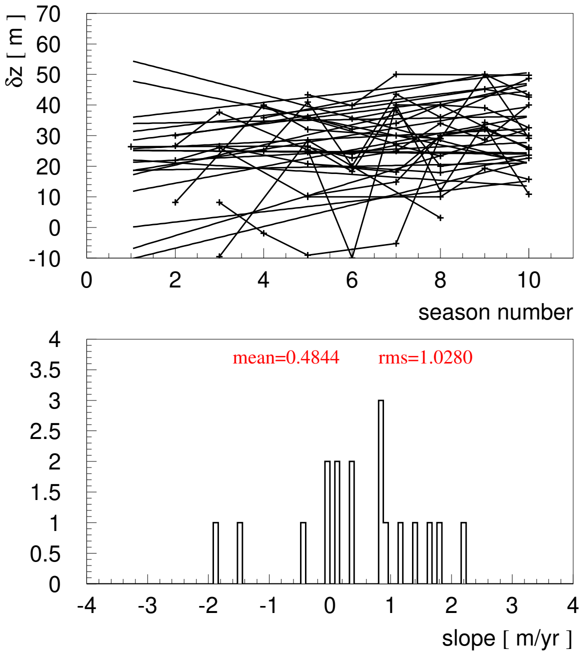
From the $+-100$ fits one can see that a global minimum exists for each working OM. The fitted surface is quite shallow on this scale and becomes more sharp on smaller grids. Also, the minimum is quite asymmetric, especially in the z direction. One would therefore like to make the grid as small as possible. However, the number of events from 2 hours of data is clearly insufficient for grids with dimensions below $+-10$ meters as the oscillations in the likelihood contribution almost completely conceal the minimum.

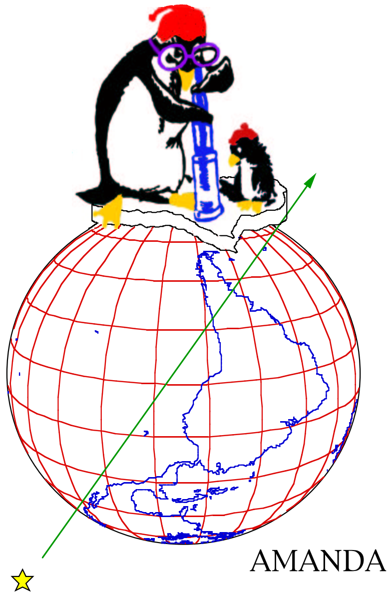




Summary of results

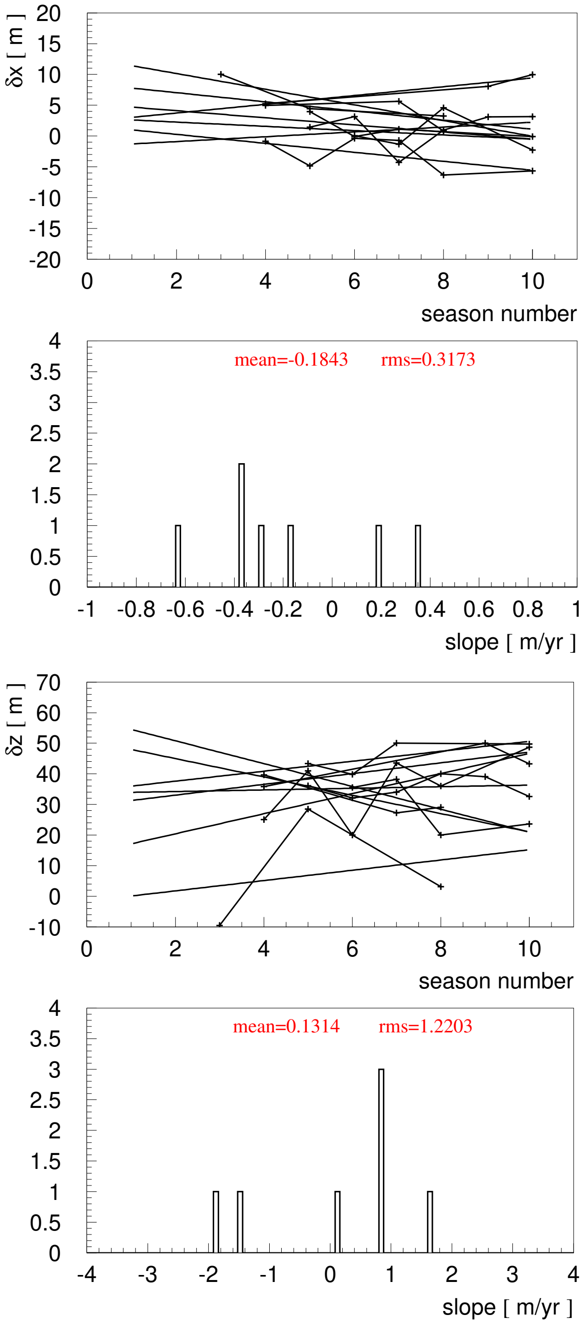


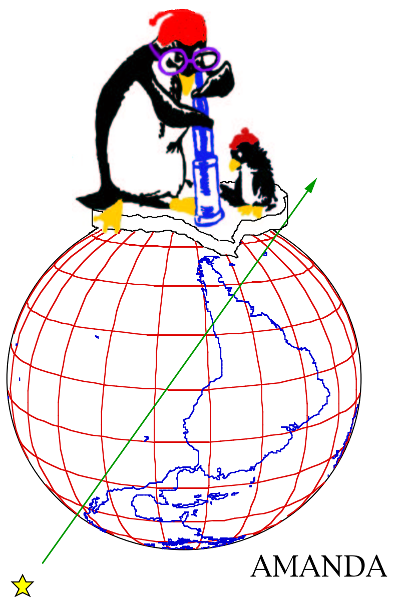




All shifts in x,y less than 10 meters, all of bottom OMs.

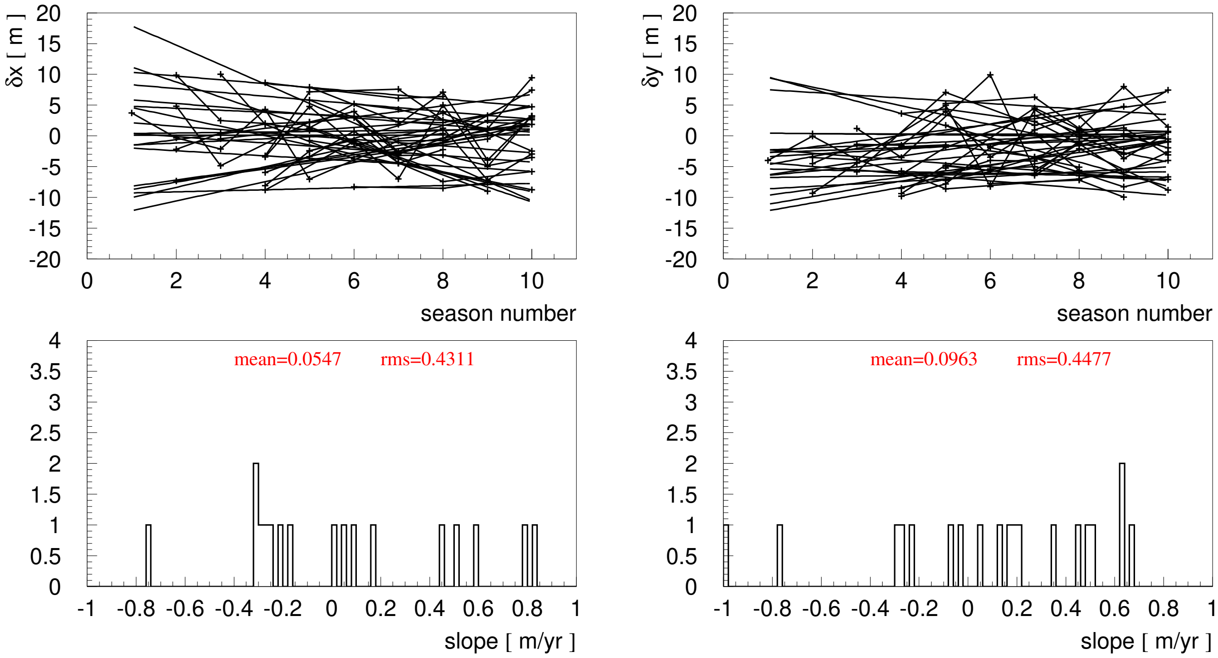
Summary of results

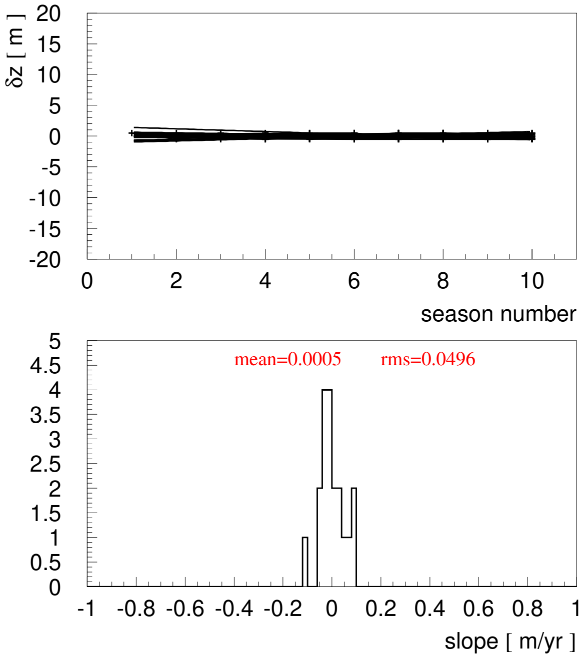


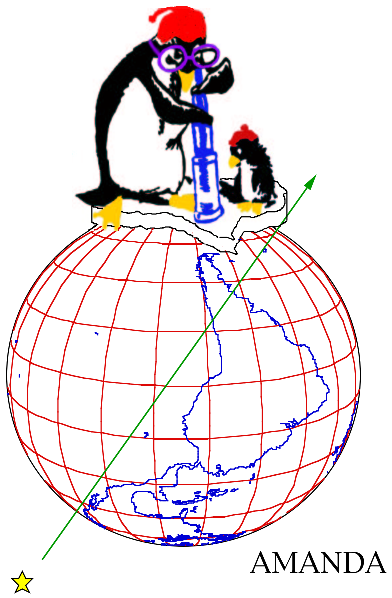


All shifts in x,y less than 10 meters, half of bottom OMs.

Summary of results

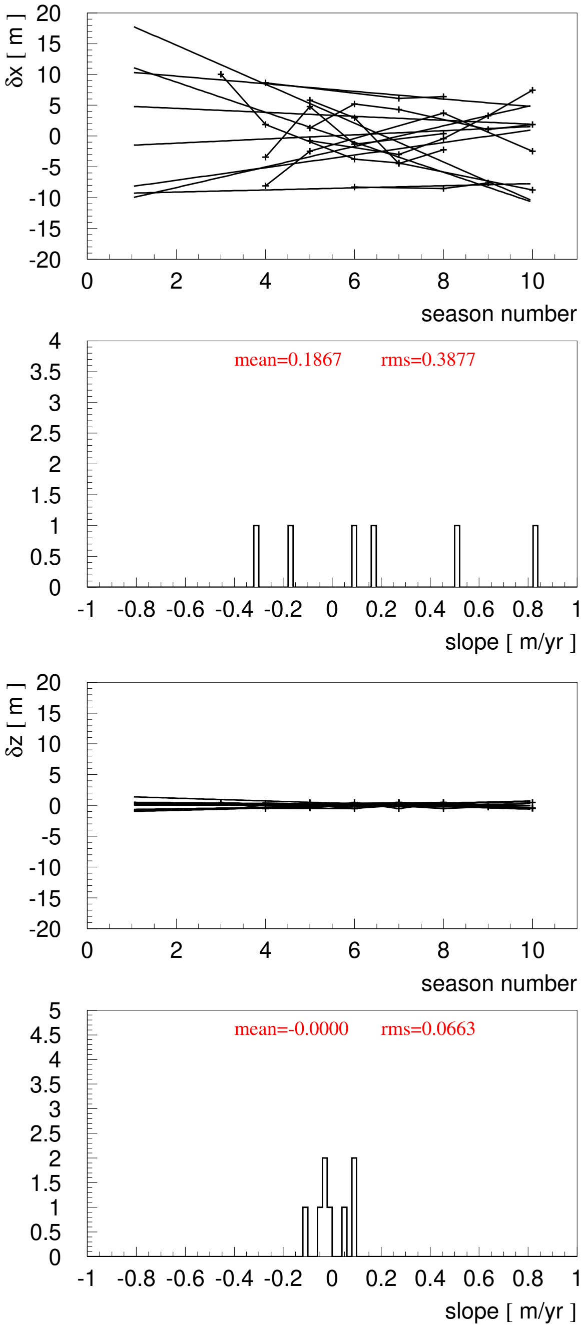


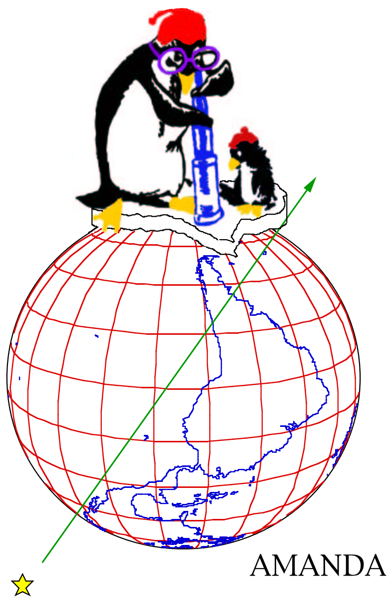




All shifts in x,y less than 10 meters, all of bottom OMs, restricted z (to $+-1$ m).

Summary of results





All shifts in x,y less than 10 meters, half of bottom OMs, restricted z (to $+-1$ m).

Conclusions

1. Software is updated since Stockholm meeting, is now more reliable and its results are now better understood.
2. To determine positions of OMs not used in the reconstruction a lot more than just 2 hours of statistics is necessary.
3. At the moment it appears that the bottom OMs move against the ice flow, if anything. At least increment in z is positive, i.e. cable pulls the OMs up as it is forced to the side by the ice flow.

Calibration & Monitoring Workshop:

Position calibration with muons, IceCube requirements

1. Muons can be used to confirm and/or refine geometry information
2. At least several days of data are necessary to get meaningful precision
3. Fully reconstructed contiguous minimum bias files (no zenith angle cutoffs) are required. These usually contain every 500th (or so) event, which is unacceptable.
4. Amount of reconstruction can be reduced substantially by only considering events with hits in the interesting OMs.
5. Precision of close to a few meters from the true location seems theoretically possible.